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Monthly Progress Letter No. 4

Contract No. A-101

System 4

1 September 1956 to 1 October 1956

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1-0. GENERAL.

1-1. During the period covered by this progress letter, all receiving equipment electrical design was completed and the mechanical design of most units was started. In addition, all antenna designs were completed and the work necessary to initiate production of prototype quantities was started. Design of all terminal equipment including the indicator, tape transport, video, and audio programming equipment are in an advanced state and the design of a system power supply was initiated.

2-0. ANTENNAS.

2-1. All basic electrical and mechanical antenna design has been completed except for a continuing effort to improve the performance of the channel I spiral antenna. This is not a critical item, however, and the necessary improvement can be effected at any time. Steps have been taken to establish the necessary quantities for prototype production of all antennas. Some of the waveguide-to-coax transitions must be fabricated in the shop since their design is too unique to be procured externally.

2-2. Tests are still underway to evaluate the suitability of radome material in the lower hatch cover. Although Teflon is satisfactory electrically, it may not be practical to use this material because the metal rings used by the airframe manufacturer to hold the radome could affect reception. As an alternative, a fiberglass radome material may be used and steps are being taken to investigate this possibility.

3-0. RECEIVING EQUIPMENT.

3-1. CHANNEL I.

3-2. A distributed amplifier having satisfactory gain characteristics has been breadboarded. The noise figure of this unit is not yet known, however. (If necessary, a bandpass filter type of design may be used as an alternative.)

3-3. All electrical breadboard design has now been completed for channels IA and IB and mechanical layout and design have been initiated. Most of the mechanical design effort will be directed toward packaging the r-f head (distributed-amplifier bandpass filters, local oscillator, and mixer circuits). The remaining channel I units will probably resemble closely the corresponding units designed for the higher channels.

3-4. CHANNELS II THROUGH VII.

3-5. All basic electrical design has now been established for all sub-assemblies comprising these equipments. Mechanical design of many of the i-f strips has been completed and is well advanced on almost all units of channels II through VII. Mechanical design of all i-f strips, f-m units, AGC/threshold units, audio-video units, and timing units should be completed, and prototype production initiated before 15 October 1956.

3-6. The receiving equipments of channels II through VII are required to effect an antenna lobing program. It had been previously established, system-wise, that this lobing would be done only after a lock had been obtained by a particular receiving equipment. During the interval covered by this progress letter, however, the project was informed that a different lobing scheme was desired. This new scheme requires that one antenna, or the other, lock-in for the entire duration of a given frequency sweep by a particular receiver regardless of the number of locks or the amount of time spent in traversing that particular sweep. This will eliminate some of the components previously required and will require only simple modifications of the tuning shafts of the receiver. This change obviates the need for a sawtooth frequency sweep and

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4-0. CAMERA INDICATOR.

4-1. As indicated in Progress Letter No. 3, the entire camera is being designed by an outside vendor. The vendor has indicated that it is not possible to supply a magazine with the necessary 800-foot capacity in time for the prototype delivery. Although it will be possible to supply this item at a later date, present planning calls for the development, directly by the project, of an interim 400-foot magazine designed so as to be replaceable by the 800-foot magazine required.

4-2. Breadboarding of the indicator is continuing with some difficulty being encountered in the design of short time-base sweep circuits. The deflection amplifier circuitry is basically completed, although the horizontal amplifier performance may prove somewhat marginal in bandwidth due, basically, to the sub-miniature tubes used. Additional breadboarding of the marker circuitry associated with the indicator remains.

5-0. VIDEO PROGRAMMER.

5-1. Breadboarding of the video programming equipment is continuing, though a sufficient amount of the programmer has been breadboarded to substantiate the basic logic. In addition, a study was conducted to determine how much of the original block diagram could be simplified component-wise and still accomplish the basic logic. This effort has resulted in the elimination of a considerable number of redundant circuits. A review is being made of the basic circuit building blocks, such as flip-flops and delay multi-vibrators, to insure that these circuits will provide reliable operation.

6-0. AUDIO PROGRAMMING EQUIPMENT.

6-1. The electrical design of all bias and erase circuits for all of the tape tracks and the electrical design of all of the circuits required to process the audio-output data delivered by the receiving channels to tape tracks 1 through 12 have been started.

6-2. As of the date of this progress letter, it is planned to provide for time multiplexing of all data appearing on tracks 13 and 14. To this end, procurement has been initiated on a suitable mechanical commutator capable of providing the necessary multiplexing function for all of the AGC data on track 13 and all of the frequency-of-operation data on track 14. Because of the change in antenna lobing technique, it is considered desirable to provide for right-left indication on track 14. Specifically, it is desired that this indication be provided in digital form as a part of the composite binary word carrying the frequency of operation information. It is proposed to use the available bits previously allowed for digital storage of navigation data.

6-3. In addition, the external addition of bits is proposed to permit the encoding of the lock information of channels I (A and B) through VII. These data are considered necessary for explicit identification of f-m activity in the ground data-reduction program.

6-4. In the event that the mechanical commutation process proves unsatisfactory, it is planned to multiplex electrically all binary data on track 14 by the use of magnetic core shift registers, with shifting pulses obtained from the 1000-cycle clock. If this must be done, it will be necessary to provide other means for multiplexing the data recorded on track 13 and these data would then be processed by a suitable frequency-division multiplex scheme.

6-5. The change in lobing technique indicated above eliminates the need for the 10-cps square wave recorded on track 14 and it will therefore no longer be considered.

7-0. POWER SUPPLY.

7-1. All power supply requirements have been established and electrical design has been started. Existing power supply design will be used wherever possible.

8-0. PLANNING.

8-1. During the next reporting interval the major effort will be directed toward:

a. completing the antenna design effort and producing a complete set of antennae for use in the prototype system

b. completing the evaluation of the radome material

c. completing the mechanical design of channel I equipment and starting prototype packaging

d. completing, as nearly as possible, all of the prototype packaging of all subassemblies relating to channels II through VII and completing the servo and gear train installations

e. completing all shop effort on the breadboard transport mechanism and testing for satisfactory performance

f. completing the mechanical design and packaging of the transistorized preamplifier for channels VIII through X -- completing the breadboard design of the demodulator unit and advancing the mechanical design as far as practicable

g. designing the 400-foot magazine for the camera

h. completing, as far as practicable, the electrical design of the video programming equipment

i. completing the electrical design of all bias and erase circuits, and processing circuits for tape channels I through XII, and advancing the mechanical design as far as practicable

j. advancing the breadboard design of circuitry associated with tape tracks 13 and 14 as far as practicable

k. advancing the electrical and mechanical design of the power supply equipment as far as practicable.